Patent claims

1. A method of automatic fault detection by crack detection by the dye penetrant method, workpieces for the dye penetrant test being treated with penetrant containing dye, concentrating the dye at surface faults, concentrating the dye at surface faults and, after a predetermined development period, being recorded by at least one image recording device and the recordings being assessed in an image processing unit by scanning and detecting areas with a concentration of dye, faults being detected and corresponding signals output, defined by

- Making recordings (A1, A2) of the same workpiece at at least two times (t1, t2) following the treatment with penetrating agent,

- Comparing the recordings (A1, A2) produced at the different times (t1, t2) and evaluating the comparison by means of the evaluation logic of the optical image processing unit, and

- Outputting signals, by means of the evaluation logic, which represent those changes in the penetrating agent concentration over the time period (Δ t1, t2) in corresponding areas on the recordings (A1, A2) which lie above a change threshold for a reference time difference; and

- Assessing the signals output, taking into account workpiece-related parameters and testing-system related operating variables, to produce assessment variables relating to crack formation, such as good/bad information, fault size assessment by a predefined size interval or in a predefined surface area.

2. The method as claimed in claim 1, wherein the optical image processing is implemented by setting windows and scanning the windows by means of the image recording device, the selection and evaluation and the indication of crack faults being automatically linked with the test sequence (cycle time), and the data obtained from this being processed in a computer.

3. The method as claimed in claim 1 or ~~2~~, wherein the image recording device

produces recordings at time intervals that are fixedly predetermined.

4. The method as claimed in claim 1 or ~~2~~, wherein by

-means of a conveying device, the workpiece is lead with the same physical orientation past at least two recording devices (K1, K2 ... Kn) arranged at a distance from one another, so that recordings (A1, A2, ..., An) made by the various image recording devices (K1, K2, ... Kn) of the workpiece with a constant physical orientation but at different times after the treatment with penetrating agent are produced, and

- the recordings (A1, A2, ..., An) from the various recording devices (K1, K2, ..., Kn) are compared with one another by evaluation logic and, from the differences between the recordings (A1, A2, ..., An), signals are formed on the basis of the time intervals that have elapsed between the recordings.

5. The method as claimed in claim 1 ~~one of the preceding claims~~, wherein reference data for the image changes (Δ Al, A2) and data relating to the time difference (Δ tn, tn+1) between the respective time periods that have elapsed between the recordings (A1, A2, . .., An) are stored in the memory of the evaluation logic, and the evaluation logic makes a comparison to see whether the measured difference values are within the prescribed threshold values and, accordingly, signals are output which represent only the faults within a predetermined time interval.

6. The method as claimed in claim 2, wherein if the cycle time of the testing sequence is not fixed, the time interval is defined by measuring the time difference (Δ tn, tn+1) between two recordings (An, An+1) of the image recording device and assigning this time period (Δ tn, tn+1) to the contrast change determined in this time interval.

7. The method as claimed in claim 1 ~~one of the preceding claims~~, wherein constituent parts and parameters of the system are monitored at predetermined time intervals by monitoring units and monitoring signals are output, which are checked by the measured-value processing unit and, accordingly, signals are output.

8. The method as claimed in claim 7,wherein the constituent parts and

parameters of the system that are to be monitored are the geometric arrangement, the focus and also the function of the at least one image recording device; the function of the illuminating device and/or the operativeness of the liquids used in the method.

9. The method as claimed in claim 8, wherein testing liquid, developer liquid and pickling liquid are used in the method.

10. The method as claimed in claim 8, wherein the bath data monitored are the respective bath temperature, the level and the contamination.

11. The method as claimed in claim 7, wherein the monitoring signals are used for controlling the system and/or its readjusting units.

12. The method as claimed in claim 1 ~~one of claims 1 to 11~~, wherein the monitoring signals and/or the signals from the measured-value processing unit are recorded on a medium.

13. The method as claimed in one of the preceding claims, wherein workpiece-related parameters are measured directly and, if appropriate, recorded.

14. The method as claimed in claim 7 ~~one of claims 7 to 12~~, wherein the monitoring signals are used to readjust the illumination intensity and/or the sensor sensitivity of the illumination monitoring sensors and/or the concentration and amount of the testing agent and/or the concentration and amount of the cleaning agent and/or the concentration and amount of the pickling agent and/or settings of the image recording device(s), such as the geometric arrangement of the focus or the sensitivity.

15. The method as claimed in claim 1 ~~one of the preceding claims~~, wherein test pieces with reference faults are automatically passed through and the operativeness of the overall system is checked by measuring them.